Accuracy in EM Fields Calculations using a Combined 1 'E-IE Approach

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ABSTRACT

A hybrid finite clement - integral equation (FE-IE) approach has been developed to calculate the EM fields scattered by inhomogeneous 3D-bodies of arbitrary shape. It couples a 1 st-order edge-bascct FE representation in a volume containing the scatterers and bounded by a surface of resolution, to an IE on the surface, to properly account for the FE mesh truncation, Hence, it solves for the component of either 1101- E along each edge in the FE mesh, as well as both E and H tangential to the surface of revolution bounding the problem domain. The code has been validated for RCS calculations on several objects with good results. Its applicability to calculate accurate fields in the near-zone of and inside penetrable scatterers is investigated here. Starling with the solution for the tangential field components at the surface of revolution, the fields are calculated everywhere in the space surrounding the problem domain. Similarly, inside the mesh volume, starling with their values along the edges, a proper linear combination yields the fields at any location, according to the chosen FE representat ion. 1 ssues such as the scatterer's geometry modeling, as well as the choice of mesh density and mesh geometry for accurate field description are discussed. in particular, the impact on accuracy of coupling the FE representation to the 1 E representation on the surface of revolution is analyzed. Specifically, the two (different) representations need to be consistent, in terms of modeling of field variation on the surface of revolution, especially about its poles. Examples arc provided for a variety of scatterers for which either analytical results or alternative numerical results arc avail able..